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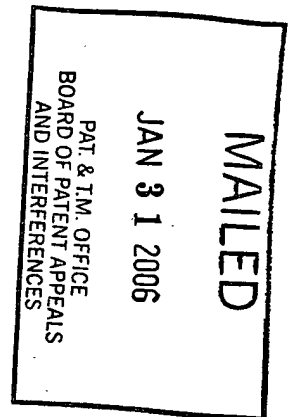
UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

Ex parte THOMAS W. SMITH AND KATHLEEN M. McGRANE

Appeal No. 2006-0049  
Application No. 10/036,590

ON BRIEF



Before TORCZON, SPIEGEL and TIERNEY, Administrative Patent Judges.

TIERNEY, Administrative Patent Judge.

*Decision on Appeal*

This is an appeal under 35 U.S.C. § 134 from the examiner's refusal to allow  
claims 1-8 and 10-25. We affirm the examiner's rejections.

*Overview of Claimed Subject Matter and Rejections*

Appellants' claims are generally directed to an ink composition comprising water and a complex of an anionic dye, an anionic lightfastness-imparting agent and a polyquaternary amine compound and its use in an inkjet printing process. (Appeal Brief, pages 5-6).

The examiner has entered three rejections against Smith's claimed subject matter.

Specifically, the examiner has made the following rejections:

- 1) Rejected claims 1-8, 11-20 and 22-25 as obvious over Gundlach, U.S. Patent 6,054,505 ("Gundlach '505") in view of Vieira, U.S. Patent No. 5,686,633 ("Vieira '633").
- 2) Rejected claims 1-7, 11-20 and 22-25 as obvious over Gundlach '505 in view of Yokoyama, U.S. Patent No. 4,256,493 ("Yokoyama '493").
- 3) Rejected claims 1-4 and 10-25 as obvious over Gundlach '505 in view of either Bergthaller, U.S. Patent 5,855,657 ("Bergthaller '657") or Ma, U.S. Patent No. 6,432,523 ("Ma '523").

Generally, the three rejections, as well as the responses thereto, are quite similar. Each rejection alleges that Gundlach '505 teaches an ink composition having water, an anionic dye and a polyquaternary amine compound. The additional references are cited by the examiner for the proposition that Smith's claimed lightfastness compounds are known in the art as providing ink compositions with a higher fastness to light. The examiner takes the position that one of ordinary skill in the art would be motivated to add the lightfastness compounds of the prior art to an ink composition having water, an anionic dye and a polyquaternary amine compound to improve the lightfastness of the ink. Smith disagrees with the examiner's rejections and generally argues that the examiner has failed to provide sufficient motivation for its claimed ink compositions. Smith's specifically claimed subject matter and the rejections are discussed in detail below.

#### *Findings of Fact*

1. The real party in interest in Smith, U.S. Application No. 10/036,590 is Xerox Corporation.
2. The 10/036,590 application was filed on November 7, 2001.

3. Claims 1 to 8 and 10 to 25 are currently pending, all of which are on appeal. (Appeal Brief, p. 3).

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4. Smith '590 claim 1 reads as follows:

An ink composition comprising (a) water and (b) a complex of (i) an anionic dye, (ii) an anionic lightfastness-imparting agent which is an ultraviolet absorber, a thiosulfate salt, a trithionate salt, a tetrathionate salt, or a mixture thereof, and (iii) a polyquaternary amine compound.

5. Smith '590 claim 12 reads as follows:

An ink according to claim 1 wherein the number of cationic sites on the polyquaternary amine molecule for every one anionic site on the lightfastness-imparting agent molecule is at least about 1, and wherein the number of cationic sites on the polyquaternary amine molecule for every one anionic site on the lightfastness-imparting agent molecule is no more than about 5.

6. Smith '590 claim 13 reads as follows:

An ink according to claim 1 wherein the molar ratio of dye lightfastness-imparting agent molecules is at least about 2:1, molecules to and wherein the molar ratio of dye molecules to lightfastness-imparting agent molecules is no more than about 20:1.

*Smith '590*

7. The Smith '590 application on appeal incorporates numerous U.S. Patents by reference including Gundlach '505, Yokoyama '493 and Bergthaller '657. (Smith '590, p. 7, line 16 to p. 9, line 23).

8. Smith '590 states that any suitable anionic dye or mixture of anionic dyes can be used and

lists several pages of suitable dyes. (Smith '590, p. 22, lines 20-21).

9. Smith '590 states that suitable anionic dyes include Food Black Nos. 1 & 2, Acid Red 35 and Yellow 23. (Smith '590, p. 22, line 20 to p. 24 line 19).

10. Smith '590 explicitly states that suitable light-fastness compounds include several structures whose formulae are disclosed in Vieira '633, the disclosure of which is totally incorporated into Smith '590. (Smith '590, p. 28, lines 9-11).

11. Smith '590 identifies numerous suitable anionic lightfastness agents including 2,3-dimethoxybenzoic acid, 3,4-dimethoxybenzoic acid, 2,6-dimethoxybenzoic acid and 3,4,5-trimethoxybenzoic acid as well as 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid. (Smith '590, p. 24, line 20 to p. 32, line 16, with the benzoic acids named on p. 28, lines 1-4).

### *The Prior Art*

#### *Gundlach '505*

12. Gundlach '505 issued on April 25, 2000 from U.S. Application 09/046,852, filed March 24, 1998. (Gundlach '505, front page). Gundlach '505 is available as prior art against Smith '590 under 35 U.S.C. §102(b).

13. Gundlach '505 lists Xerox Corporation as its assignee.

14. Xerox is also the assignee of the Smith '590 application on appeal.

15. Gundlach '505 describes an ink composition having:

(1) water; (2) a nonpolymeric salt comprising at least one cation and at least one anion; and (3) a colorant comprising an anionic dye complexed with a polyquaternary amine compound.

(Gundlach '505, abstract).

16. Gundlach '505 teaches that its ink compositions are suitable for use in ink jet printing processes. (Gundlach '505, col. 1, lines 6-8).

17. Gundlach '505 states that "any suitable or desired anionic dye" may be used in its ink composition. (Gundlach '505, col. 13, lines 31-32).

18. The polyquaternary amine compound of Gundlach '505 is present in any desired or effective amount, typically from about 0.01 to about 50 percent by weight of the ink. (Gundlach '505, col. 13, lines 15-23).

19. Suitable polyquaternary amine compounds for Gundlach '505 include:

[P]olydiallyl ammonium compounds, polyquaternized polyvinylamines, polyquaternized polyallyl amines, epichlorohydrin/amine copolymers, cationic amido amine copolymers, copolymers of vinyl pyrrolidinone and a vinyl imidazolium salt, and mixtures thereof.

(Gundlach '505, abstract).<sup>1</sup>

20. Gundlach '505 teaches that it is preferred that the number of quaternary amine groups on the polyquaternary amine compound exceeds the number of anionic groups on the dye to avoid precipitation. Specifically, Gundlach '505 states that:

In another preferred embodiment, the polyquaternary amine compound is present in the ink in an amount such that the number of quaternary amine groups on the polyquaternary amine compound exceeds the number of anionic groups on the dye. In some instances, particularly when the ink vehicle contains cosolvents such as sulfolane and/or urea and a salt, when the dye and polyquaternary amine compound are present in relative amounts such that the number of anionic groups on the dye exceeds the number of cationic quaternary amine groups on the polymer, precipitation of the dye/polyquaternary amine complex from the ink vehicle can occur. Increasing the amount of polyquaternary amine compound in the ink in these instances enables an ink with excellent shelf stability, excellent waterfastness, excellent smear resistance, and reduced intercolor bleed.

(Gundlach '505, col. 22, lines 1-14).

21. The molar ratio of anionic dye groups to cationic polyquaternary groups in Gundlach '505 is typically between 1:0.33 to about 1:300, but is most preferably 1:3, although the relative amounts can be outside these ranges. (Gundlach '505, col. 13, lines 23-30).

22. Gundlach '505 states that its ink composition may be incorporated into an ink jet printing apparatus from which droplets of the ink composition may be ejected in an imagewise pattern onto a substrate such as paper. (Gundlach '505, col. 23, line 55 to col. 24, line 5).

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<sup>1</sup>We note that claim 3 of Smith '590 and Gundlach's abstract provide identical recitations of polyquaternary amine compounds.

*Vieira '633*

23. Vieira '633 issued on November 11, 1997 from U.S. Application 07/815,201, filed December 31, 1991. (Vieira '633, front page). Vieira '633 is available as prior art against Smith '590 under 35-U.S.C. §102(b).

24. Vieira '633 describes inks for ink jet printing that contain at least one light stabilizing compound. (Vieira '633, abstract). In particular, Vieira '633 is directed to the addition of light stabilizing hydroquinone derivatives to ink compositions. (Vieira '633, col. 1, lines 6-9).

25. Vieira '633 teaches that its light stabilizing compound can be used with water-soluble dyes, including anionic dyes such as Food Black 2, Acid Red 35, Acid Yellow 23. (Vieira '633, col. 7, lines 22-34).

26. Vieira '633 states that, regarding the use of Vieira's described light stabilizing compound, the nature of the ink, the type of dye dissolved in it and the type of printed used are immaterial. (Vieira '633, col. 7, lines 3-5).

27. Vieira '633 Example 3 compares ink jet printing inks having a stabilizer against an ink that does not contain a stabilizer.

28. In Vieira '633, Example 3, several stabilizers were tested with inks having different dyes in them. The tested stabilizers included 2,3-dimethoxybenzoic acid, 3,4-dimethoxybenzoic acid, 2,6-

dimethoxybenzoic acid and 3,4,5,-trimethoxybenzoic acid. The stabilizers were tested with dyes including anionic dyes Acid Yellow 23, Acid Red 35 and Food Black 2.

~~29. According to Vieira '633, Example 3, the presence of a stabilizer provided a higher~~  
fastness to light. (Vieira '633, Example 3, Table 2).

*Yokoyama '493*

30. Yokoyama '493 issued on March 17, 1981 from U.S. Application 81,930, filed October 4, 1979. (Yokoyama '493, front page). Yokoyama '493 is available as prior art against Smith '590 under 35 U.S.C. §102(b).

31. Yokoyama '493 describes an aqueous jet ink composition having a water-soluble dye, a wetting agent, water and a water-soluble ultraviolet absorbing agent, as well as a metal salt, when necessary. (Yokoyama '493, abstract).

32. Yokoyama '493 states that its aqueous jet ink compositions relate to an improved ink that is capable of being used for a long period of time without clogging a jet printer nozzle and provides good resistance to light. (Yokoyama '493, col. 1, lines 6-11 and col. 3, lines 10-19).

33. According to Yokoyama '493, water-soluble dyes used in conventional aqueous jet ink compositions have poor light-resistance. (Yokoyama '493, col. 2, lines 62-64).



34. Yokoyama '493 specifically identifies and exemplifies 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid and 2,2'-dihydroxy-4,4'-dimethoxybenzophenone-5-sulfonic acid as effective ultraviolet absorbing agents for its jet ink compositions. (Yokoyama '493, col. 3, lines 34-60 and Table 1).

35. Yokoyama '493 states that the type of water-soluble dye used in its aqueous jet ink composition "is not particularly critical so long as the dye has good water solubility." (Yokoyama '493, col. 4, lines 59-65).

36. Yokoyama '493 exemplifies ink jet compositions having C.I. Direct Blue 15 in combination with 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid and 2,2'-dihydroxy-4,4'-dimethoxybenzophenone-5-sulfonic acid. (Yokoyama '493, Table 1, Examples 3, 6 and 8). These exemplified compositions possessed "excellent" light resistance as compared to the "poor" light resistance shown by a comparative ink composition lacking the ultraviolet absorbing agents. (Yokoyama '493, Table 1, Examples 3, 6, 8 and Comparative Example 2).

#### *Bergthaller '657*

37. Bergthaller '657 issued on January 5, 1999 from U.S. Application No. 08/923,139, filed September 4, 1997. Bergthaller '657 is available as prior art against Smith '590 under 35 U.S.C. §102(b).

38. Bergthaller '657 states that:

It is known that the light-fastness of images which are produced by the inkjet process is insufficient, and cannot compete, for example, with the light-fastness of color photographic images which are produced by the conventional chromogenic process on color photographic paper.

(Bergthaller '657, col. 1, lines 15-19).

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39. Bergthaller '657 teaches that the inclusion of 0.2 to 8% by weight, with respect to the ink basis, of an inorganic thiosulphate, trithionate or tetrathionate, which is soluble in ink, or an organic thiosulphate, will improve the lightfastness of an inkjet composition. (Bergthaller '657, col. 1, lines 34-41).

40. Bergthaller '657 exemplifies anionic dyes in combination with its lightfastness agent, including Acid Yellow 23 and Direct Blue 86. (Bergthaller '657, Examples, col. 5, lines 39-44).

41. Bergthaller '657's examples show that density loss was higher in the comparative examples that did not contain the lightfastness agent. (Bergthaller '657, Table).

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*Ma '523*

42. Ma '523 issued on August 13, 2002 based upon U.S. Application 09/693,531, filed October 19, 2000. Ma '523 is available as prior art against Smith '590 under 35 U.S.C. §102(e).

43. Ma '523 teaches that lightfastness compounds may be incorporated into inks. Specifically, Ma '523 states:

Additional improved lightfastness is achieved by incorporating in the ink itself one or more of the above-listed additive compounds of potassium or sodium iodide, sodium or potassium thiosulfate, and sodium thiocyanate.

(Ma '523, col. 5, lines 63-66).

### *Opinion*

Smith '590 claims 1 to 8 and 10 to 25 are currently pending, all which are on appeal. As noted above, the examiner made three rejections which, taken together, allege that all of Smith's claims are obvious over the prior art. In particular, the examiner relies upon Gundlach '505 for its teaching of an ink composition having water, an anionic dye and a polyquaternary amine compound. The examiner relies upon various additional references for their teaching that Smith's claimed lightfastness compounds are known in the art to provide improved lightfastness properties to anionic dye ink compositions.

Smith disagrees with the rejection of its claims. Smith's Appeal Brief addresses the specifics of each of the examiner's rejection but does not explicitly state whether or not Smith's appealed claims stand or fall together or provide separate subheadings identifying claims that are to be considered separately. 37 C.F.R. §41.37(a)(vii). Smith presents arguments as to why its claims as a whole are patentable over the cited prior art and further identifies claims 12 and 13 as further distinguishing over the prior art. (See, e.g., Appeal Brief, p. 21). Accordingly, the Board exercises its discretion and selects Smith claim 1 as representative of the claims as a whole and additionally reviews the separate arguments presented for claims 12 and 13. 37 C.F.R. §41.37(a)(vii).

- 1) Rejection of Smith Claims 1-8, 11-20 and 22-25 as obvious over Gundlach '505 in view of Vieira '633

There is no dispute that each of the ingredients recited in Smith's claims on appeal are known in the art. Specifically, both the examiner and Smith agree that Gundlach '505 describes an ink composition having (1) water; (2) a nonpolymeric salt comprising at least one cation and at least one anion; and (3) a colorant comprising an anionic dye complexed with a polyquaternary amine compound. (Appeal Brief, p. 8). Further, both the examiner and Smith agree that Gundlach '505 does not teach the use of lightfastness agents such as ultraviolet absorbers, thiosulfate salts, trithionate salts or tetrathionate salts. (Appeal Brief, p. 11). The examiner and Smith also agree that Vieira '633 teaches the addition of anionic lightfastness agents, such as those claimed by Smith, into inks. (Appeal Brief, p. 11). The examiner and Smith disagree however, as to whether or not Gundlach '505 and Vieira '633 suggest using an anionic lightfastness agent in an ink composition such as that described by Gundlach '505. (Appeal Brief, p. 11).

According to the examiner, Vieira '633 motivates one of ordinary skill in the art to use a lightfastness agent in the ink composition of Gundlach '505 to "produce stable ink that will not fade or discolor." (Examiner's Answer, p. 5). The examiner recognizes that neither Gundlach '505 nor Vieira '633 disclose the formation of a complex between the dye, polyquaternary amine and the lightfastness agent of Vieira '633, yet, the examiner takes the position that a complex will form. According to the examiner, given that Gundlach '505 and Vieira '633 motivate one skilled in the art to form an ink composition having the same polyquaternary amine, anionic dye and lightfastness imparting agent as that claimed by Smith, a complex will form such as that described

by Smith. (Examiner's Answer, p. 5).

Smith argues that Gundlach '505 does not teach or suggest the addition of Smith's claimed lightfastness agents in Gundlach's ink compositions. Smith also argues that Vieira '633 does not teach or suggest that lightfastness agents be included in an ink composition having a polyquaternary amine or teach that such agents "could or should form complexes with other ink ingredients." (Appeal Brief, p. 11).

As all the ingredients of Smith's claimed ink composition are known in the art, the question before us is whether or not the combination of ingredients as a whole was obvious.

Specifically, the Federal Circuit has stated that:

[S]ection 103 requires assessment of the invention as a whole. This "as a whole" assessment of the invention requires a showing that an artisan of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the various elements from the prior art and combined them in the claimed manner. In other words, section 103 requires some suggestion or motivation, before the invention itself, to make the new combination. (citations omitted).

*Princeton Biochemicals Inc. v. Beckman Coulter Inc.*, 411 F.3d 1332, 1337, 75 USPQ2d 1051, 1054 (Fed. Cir. 2005).

Vieira '633 states that dyes used in ink jet compositions are known to have "limited storage life under the action of light" and that there is "a need for effective light stabilizers for inks." (Vieira '633, col. 1, lines 21-26 and 64-65). Vieira '633 further teaches that the inks described by Vieira "are distinguished by an unexpected improvement in quality." (Vieira '633, col. 6, lines 55-56). Vieira '633 provides specific examples of its ink lightfastness compounds in combination with anionic dyes for ink jet printing inks and demonstrates that the combination of the two provides improved lightfastness over a composition lacking the lightfastness compound.

(Vieira '633, Example 3).

Gundlach '505 teaches an ink composition having Smith's water, polyquaternary amine compound and an anionic dye. Gundlach '505 states that its ink compositions provide "improved ink compositions suitable for ink jet printing processes." (Gundlach '505, col. 6, lines 9-11). According to Gundlach, its ink compositions have numerous advantages including the use of acid dyes complexed with cationic polymers which allows for bright colors, low cost and high waterfastness. (Gundlach '505, col. 6, lines 20-24). Gundlach recognizes however, that a need remains in the art for ink compositions with improved lightfastness and that an objective of Gundlach '505 is "to provide ink compositions with improved lightfastness." (Gundlach '505, col. 6, lines 3-4 and 40-41).

Taking Smith's invention as a whole, we conclude that a person of ordinary skill in the art was aware of the problems associated with anionic dye ink jet compositions, including the need for improved lightfastness. The person of ordinary skill in the art desiring the benefits of Gundlach '505's improved anionic dye ink jet composition, bright colors, low cost, etc. would have been motivated to include the anionic lightfastness agent of Vieira '633 as Vieira teaches that such agents provide improved lightfastness for anionic dye jet printing inks.

Smith argues that Gundlach and Vieira fail to motivate one of ordinary skill to form the claimed ink wherein both the anionic dye and anionic lightfastness-imparting agent are complexed with the polyquaternary amine. (Appeal Brief, p. 11). Smith is reminded that the motivation in the prior art to combine the Gundlach and Vieira references and establish the obviousness of Smith's claimed subject matter does not have to be identical to the motivation identified by Smith.

*In re Dillon*, 919 F.2d 688, 693, 16 USPQ2d 1897, 1901 (Fed. Cir. 1990) (en banc).

The Gundlach '505 and Vieira '633 references motivate one of ordinary skill in the art to combine the same polyquaternary amine, anionic dye and anionic lightfastness agent as claimed by Smith. A natural consequence of combining these ingredients is the formation of a complex, such as that mentioned in Smith's claims. In particular, Gundlach '505 explicitly states its anionic dye is complexed with a polyquaternary amine compound. (Gundlach '505, abstract, col. 7, lines 25-27, and col. 14, lines 49-52). Gundlach '505 teaches that:

While not being limited to any particular theory, it is believed that the polyquaternary amine and the dye form a multidentate ionic complex upon admixing of the ink ingredients. While the ink ingredients can be mixed in any desired order, it is preferred that any salts present in the ink be added prior to addition of the dye or the polyquaternary amine. The structure of the polyquaternary complex generally is independent of ink pH over the normal pH range of the ink.

(Gundlach '505, col. 15, lines 42-50). Further, Gundlach '505 specifically identifies the anionic dye as "playing the role of a counterion." (Gundlach '505, col. 20, lines 15-19). Gundlach '505's teaching of admixing the ink ingredients to form a complex of cationic and anionic components is consistent with the formation of Smith's complex. Smith's specification teaches that:

The complex of the anionic dye, anionic lightfastness-imparting agent, and polyquaternary amine compound can be prepared by any desired or suitable method. For example, these ingredients can all be admixed with the other ink ingredients so that the complex forms within the ink.

(Smith '590 specification, p. 33, line 27 to p. 34, line 3). As Gundlach '505 and Vieira '633 motivate one of ordinary skill in the art to admix the same polyquaternary amine, anionic dye and anionic lightfastness agent as that claimed by Smith, we determine that a natural consequence of admixing these ink ingredients will be the formation of complex between the polyquaternary amine and the anionic dye and anionic lightfastness agent, such as that identified by Smith when

admixing identical components.

Additionally, regarding the formation of a complex, we note that Smith does not argue that a complex will not form when the prior art polyquaternary amine is admixed with the anionic dye and anionic lightfastness agent. Indeed, it stands to reason that Gundlach's teaching of a complex between the polyquaternary amine (positively charged) and the anionic dye (negatively charged) "counterion" would lead one of skill in the art to conclude that the admixture of another negatively charged anionic compound (anionic lightfastness agent) would lead to the formation of a complex between the positively charged polyquaternary amine with both of the negatively charged anionic compounds (dye and lightfastness agent).

Smith directs our attention to Smith's specification, which identifies certain benefits that are "believed" to be associated with having the lightfastness-imparting agent and anionic dye both complexed with the polyquaternary ammonium. (Appeal Brief, pages 11-12). Smith's belief as to potential benefits is noted, but this belief stated in the specification does not rise to the level of conclusive evidence of unexpected results. See e.g., *In re Geisler*, 116 F.3d 1456, 1470-1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997); *In re Soni*, 54 F.3d 746, 750, 34 USPQ2d 1684, 1687 (Fed. Cir. 1995).

Smith argues that the examiner engaged in hindsight and used the inventor's disclosure as a blueprint for piecing together the Gundlach '505 and Vieira '633 references to arrive at Smith's claimed invention. Both of the references relied upon by the examiner, Gundlach '505 and Vieira '633, identify lightfastness as a known problem for anionic dyes in ink jet compositions. Thus, the motivation to combine the references, and to use Vieira's improved lightfastness compounds with Gundlach's anionic dye ink jet ink composition having bright colors and low cost, comes from the



references themselves and not Smith's specification. *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (To prevent use of hindsight, court requires motivation).

-----Smith argues that the examiner may be attempting to employ an obvious to try standard. (Appeal Brief, p. 12). Smith provides a page and a half discussion on obvious to try case law and applies the case law to the examiner's rejection by stating:

Since nothing in the cited references, viewed in combination, teaches or suggests to one of ordinary skill in the art an ink as recited in claims 1 to 8, 11 to 20, and 22 to 25, Appellants are of the position that these claims are patentable with respect to the teachings of the cited references.

(Appeal Brief, pages 12-14).

The Federal Circuit has provided the following comments regarding the inappropriateness of an "obvious to try" standard:

The admonition that "obvious to try" is not the standard under § 103 has been directed mainly at two kinds of error. In some cases, what would have been "obvious to try" would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful. [Citations omitted]. In others, what was "obvious to try" was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.

*In re O'Farrell*, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988).

We agree with Smith that obvious to try is not the appropriate standard to determine obviousness. Smith however, fails to identify what specific fact or conclusion reached by the examiner was in error. The examiner has identified prior art that teaches the need for improved lightfastness for anionic dye ink jet inks and also has identified a reference, Vieira '633 that

describes the use of anionic lightfastness agents to reduce the problems associated with poor lightfastness in anionic dye ink jet inks such as Gundlach '505's. Smith does not explain why the prior art teachings would have required varying numerous parameters and possible choices to arrive at the claimed subject matter. Nor has Smith explained why the anionic dye ink jet ink composition art represents a "new technology or general approach that seemed to be a promising field of experimentation." *Id.* We hold that the examiner's combination of the teachings of Gundlach '505 and Vieira '633 does not involve an obvious to try approach to patentability.

Smith argues that the references fail to teach or suggest the desirability of combining the ingredients as claimed. (Appeal Brief, p. 16-20). According to Smith, the examiner has improperly attempted to use Smith's specification as a "blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention." As discussed above, the motivation to combine Gundlach '505 and Vieira '633 comes from the teachings of the references themselves and not Smith's specification.

Smith also argues that Smith claims 12 and 13 further distinguish over the prior art. Smith claim 12 depends from Smith claim 1 and further limits claim 1 by requiring a ratio of cationic sites on the polyquaternary amine to anionic sites on the lightfastness-imparting agent to range from about 1:1 to no more than about 5:1. (Appeal Brief, A-6). Smith claim 13 also depends from Smith claim 1 and further limits claim 1 by requiring the molar ratio of dye molecules to lightfastness-imparting agent to range from about 2:1 to no more than about 20:1. (Appeal Brief, A-6).

Smith claim 12 requires that the number of cationic sites on the polyquaternary amine

molecule for every anionic site on the lightfastness agent is at least about 1 and no more than about 5. (Appeal Brief, A-6). Smith argues that the prior art does not provide guidance as to Smith's claimed "desirable" ratio. Smith does not allege that its claimed range of cationic groups on the polyquaternary amine to anionic groups on the lightfastness agent provides an unexpected result compared to the prior art. (Appeal Brief, p. 21).<sup>2</sup>

The "discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill in the art." *In re Boesch*, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980). Specifically, where the general conditions of the claims are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). Indeed, a prima facie case of obviousness arises when the ranges of a claimed composition overlap the ranges disclosed in the prior art. *In re Woodruff*, 919 F.2d 1578, 65 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Gundlach teaches one of ordinary skill in the art that the number of cationic quaternary amine groups should exceed the number of anionic groups on the dye in order to avoid

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<sup>2</sup> According to Smith:

While Gundlach et al. provides general guidance with respect to desirable ratios of anionic dye to polyquaternary amine, it does not provide guidance to one of ordinary skill in the art in determining desirable relative ratios of anionic lightfastness-imparting agent to polyquaternary amine molecule when the ink contains a complex of an anionic dye, an anionic lightfastness-imparting agent, and a polyquaternary amine compound. In addition, this reference provides no guidance to one of ordinary skill in the art in determining desirable relative ratios of anionic lightfastness-imparting agent to anionic dye when the ink contains a complex of an anionic dye, an anionic lightfastness-imparting agent, and a polyquaternary amine compound. Accordingly, Appellants remain of the position that claims 12 and 13 are particularly in condition for allowance.

(Appeal Brief, p. 21).

precipitation of the dye/polyquaternary amine complex. Vieira suggests the addition of lightfastness groups to prevent fading by UV light, but does not mention the ratio of cationic to anionic. However, one of ordinary skill in the art reading Gundlach would understand that the total number of cationic groups on the amine should exceed the total number of anionic groups in the dye and lightfastness imparting agent composition to avoid potential precipitation of an anionic/cationic complex, i.e., the ratio of cationic groups to anionic lightfastness groups must also be greater than 1 to avoid precipitation. Thus, Gundlach '505 in combination with Vieira '633 teaches the combination of the dye, lightfastness agent and polyquaternary amine and provides general guidance as to their proportions. The selection of Smith's claimed "desirable" ratio of about 1:1 to about 5:1 cationic group to anionic lightfastness group is within the skill in the art as it is not inventive to discover workable ranges by routine experimentation. *Id.*

Smith claim 13 requires the molar ratio of dye molecules to lightfastness imparting agent molecules to range from at least about 2:1 to no more than 20:1. (Appeal Brief, A-6). Smith argues that:

[T]he Examiner has stated that Gundlach et al discloses using 1 to 5 percent anionic dye while Vieira et al. discloses using 0.1 to 2 percent anionic lightfastness agent. Appellants point out that (a) this ratio is not directed to the two components complexed to a polyquaternary amine, and (b) this ratio is substantially broader than that recited in claim 13. Accordingly, Appellants remain of the position that claim 13 is particularly in condition for allowance.

(Appeal Brief, p. 21). As acknowledged by Smith, Gundlach '505 and Vieira '633, taken together, suggest using ratios of dye to lightfastness agent that are broader than those recited in Smith claim 13. As the claimed ranges overlap the ranges disclosed in the prior art, the claimed ranges are prima facie obvious. Further, Smith does not argue, let alone allege, that Smith's

claimed range provides an unexpected result. Based upon the record presented, we conclude that Smith's claimed workable range of dye to lightfastness agent would have been obvious to one of ordinary skill in the art.

~~—————In summary, for the reasons provided above, we affirm the examiner's rejection of Smith claims 1-8, 11-20 and 22-25 as obvious over Gundlach '505 in view of Vieira '633.~~

2) Rejection of Smith Claims 1-7, 11-20 and 22-25 as obvious over Gundlach '505 in view of Yokoyama '493

The examiner's rejection of Smith claims 1-7, 11-20 and 22-25 as obvious over Gundlach '505 in view of Yokoyama '493 is similar to that discussed above with respect to Gundlach '505 in view of Vieira '633. Generally, the examiner argues that Gundlach '505 teaches an ink that can be used in ink jets comprising water, nonpolymeric salt, 1-5% anionic dye and a polyquaternary amine. (Examiner Answer, p. 6). The examiner states that Yokoyama '493 is drawn to ink jet inks and employs a UV absorbing agent, such as 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid<sup>3</sup> to produce an ink having good resistance to light and will not clog printer nozzles. (Examiner Answer, p. 7). According to the examiner, motivation to employ the anionic lightfastness agents of Yokoyama '493 in Gundlach '505 as the inclusion of the lightfastness agent will "produce ink with good resistance to light that will not clog the printer nozzles, and thereby arrive at the claimed invention." (Examiner Answer, pages 7-8). The examiner also argues that it would have been obvious to control the ratio of cationic sites on the polyquaternary amine to

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<sup>3</sup>The compound 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid is identified by Smith '590 as being a suitable, commercially available anionic lightfastness agent. (Smith '590, p. 27, lines 18-19).

anionic groups on the lightfastness agent and arrive at Smith's claimed invention as Gundlach teaches that the number of cationic groups must be larger than the anionic groups to avoid precipitation and produce an ink with excellent shelf stability. (Examiner Answer, p. 8).

~~Additionally, with respect to Smith claim 13, which identifies a range of anionic-dye-to-anionic lightfastness agent of from 2:1 to 20:1, the examiner relies upon Yokoyama '493's teaching of a ratio of anionic dye to UV absorbing agent of 0.1-10:0.2-10 or 0.01:1 to 50:1. (Final Office Action, p. 10, citing Yokoyama '493, col. 5, lines 26-32).~~

Smith disagrees with the examiner's position. Smith's arguments with respect to the combination of Gundlach '505 in view of Yokoyama '493 are nearly identical to those presented, and discussed above, with respect to Gundlach '505 in view of Vieira '633. To demonstrate the similarity between the responses, two quotations from Smith's Appeal Brief are provided below:

STATEMENTS IN SMITH'S APPEAL BRIEF	
Response to Examiner's Rejection over Gundlach '505 in view of Vieira '633	Response to Examiner's Rejection over Gundlach '505 in view of Yokoyama '493
<p>Appellants disagree with this position. Gundlach et al. neither teaches nor suggests the use of lightfastness agents such as ultraviolet absorbers, thiosulfate salts, trithionate salts, or tetrathionate salts in the inks disclosed therein. Vieira et al. teaches simple addition of lightfastness agents of the given formula into inks, and neither teaches nor suggests that such agents could or should form complexes with other ink ingredients. Vieira et al. further fails to teach or suggests inks containing polyquaternary amines. One of ordinary skill in the art would not be motivated to view these particular references in combination and would not be led to make an ink wherein <u>both</u> an anionic dye and an anionic lightfastness-imparting agent are complexed to a polyquaternary amine. . . . [Brief then quotes from application and cites case law on obvious to try standard and that "references" do not teach or suggest claims 12 and 13 with discussion identical to that on pages 24 to 28]. (Appeal Brief, pages 11 to 15).</p>	<p>Appellants disagree with this position. Gundlach et al. neither teaches nor suggests the use of lightfastness agents such as ultraviolet absorbers, thiosulfate salts, trithionate salts, or tetrathionate salts in the inks disclosed therein. Yokoyama et al. teaches simple addition of lightfastness agents of the given formula into inks, and neither teaches nor suggests that such agents could or should form complexes with other ink ingredients. Yokoyama further fails to teach or suggests inks containing polyquaternary amines. One of ordinary skill in the art would not be motivated to view these particular references in combination and would not be led to make an ink wherein <u>both</u> an anionic dye and an anionic lightfastness-imparting agent are complexed to a polyquaternary amine. . . . [Brief then quotes from application and cites case law on obvious to try standard and that "references" do not teach or suggest claims 12 and 13 with discussion identical to that on Appeal Brief pages 11 to 15]. (Appeal Brief, pages 24 to 28).</p>

Smith's arguments regarding the rejection over Gundlach '505 in combination with Yokoyama '493 have been fully considered. Yet, for essentially the same reasons provided above with respect to Gundlach '505 in combination with Vieira '633, we conclude that Smith claims 1-7, 11-20 and 22-25 are obvious over Gundlach '505 taken in light of Yokoyama '493. Specifically, we conclude that one of ordinary skill in the art was well aware that there was a need in the art for ink compositions with improved lightfastness. Further, we find that an objective of Gundlach '505 is "to provide ink compositions with improved lightfastness." (Gundlach '505,

col. 6, lines 3-4 and 40-41). A person of ordinary skill in the art desiring the benefits of Gundlach '505's improved anionic dye ink jet composition, bright colors, low cost, etc. would have been motivated to include the anionic lightfastness (UV) agent of Yokoyama '493 as Yokoyama provides examples demonstrating that compositions having anionic dyes with anionic lightfastness agents possessed "excellent" light resistance as compared to the "poor" light resistance shown by a comparative ink composition lacking the lightfastness agents. (Yokoyama '493, Table 1, Examples 3, 6, 8 and Comparative Example 2). Further, as discussed above, a natural consequence of combining the anionic dye, anionic light-fastness agent and the cationic polyquaternary amine is the formation of a complex.

As to Smith claims 12 and 13, Gundlach '505 and Yokoyama '493, taken together, suggest using ratios of cationic to anionic groups and dye to lightfastness agent that are broader than those recited in Smith's claims. Yet, a prima facie case of obviousness arises when the ranges of a claimed composition overlap the ranges disclosed in the prior art. *In re Woodruff*, 919 F.2d 1578, 65 USPQ2d 1934, 1936 (Fed. Cir. 1990). Smith does not argue, let alone allege, that Smith's claimed range provides an unexpected result. Based upon the record presented, we conclude that Smith's claimed workable range of dye to lightfastness agent and cationic to anionic groups would have been obvious to one of ordinary skill in the art.

3) Rejection of Smith Claims 1-4 and 11-25 as obvious over Gundlach '505 in view of Bergthaller '657 or Ma '523

The examiner's rejection of Smith claims 1-4 and 11-25 over Gundlach '505 in view of Bergthaller '657 or Ma '523 is similar to that discussed above with respect to the two rejections



discussed above. As with the above two rejections, the examiner generally argues that Gundlach '505 teaches an ink composition that contains water, 1-5% anionic dye, including Acid Red 52, Acid Yellow 23 and Acid Blue 9, and a polyquaternary amine, such as polydiallyl dimethyl ammonium. (Examiner Answer, p. 8). The examiner cites Gundlach '505 as teaching that its ink may be used in a thermal ink jet printer as well as other conventionally known ink jet printing methods, such as acoustic ink jet printing and piezoelectric ink jet processes. (Examiner Answer, p. 9). The examiner cites Ma '523 as describing ink jet inks having 1-8% thiosulfate salt in order to improve lightfastness. (Examiner Answer, p. 9, citing Ma '523, col. 5, lines 63-66). The examiner also relies on Bergthaller '657 as teaching ink jet ink containing dyes, such as Acid dyes, having 0.2-8% thiosulfate, trithionate or tetrathionate salts to produce inks having improved color fastness. (Examiner Answer, p. 9, citing Bergthaller '657, col. 1, lines 34-41 and col. 5, line 40).<sup>4</sup> According to the examiner, it would have been obvious to one of ordinary skill in the art to include the thiosulfate lightfastness agents of Ma '523 and/or the thiosulfate, trithionate or tetrathionate salts of Bergthaller '657 in the ink jet composition of Gundlach '505 because Gundlach '505 recognizes that lightfastness is a known problem in the ink jet art and Ma '523 and Bergthaller '657 teach that the inclusion of the identified lightfastness agents in inkjet inks provides improved lightfastness. (Examiner Answer, p. 9).

Smith disagrees with the examiner's position. Smith's arguments with respect to the

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<sup>4</sup>We note that Bergthaller '657's abstract specifically states that:

An inkjet ink results in improved color-fastness if the ink contains a water-soluble inorganic thiosulphate, trithionate or tetrathionate or an organic thiosulphate, in an amount of 0.2 to 8% by weight with respect to the ink base.

(Bergthaller '657, abstract).

combination of Gundlach '505 in view of Bergthaller '657 or Ma '523 are virtually identical to those discussed above with respect to the two rejections discussed above. To demonstrate the similarity between the responses, two quotations from Smith's Appeal Brief are provided below:

STATEMENTS IN SMITH'S APPEAL BRIEF	
Response to Examiner's Rejection over Gundlach '505 in view of Vieira '633	Response to Examiner's Rejection over Gundlach '505 in view of Bergthaller '657 or Ma '523
<p>Appellants disagree with this position. Gundlach et al. neither teaches nor suggests the use of lightfastness agents such as ultraviolet absorbers, thiosulfate salts, trithionate salts, or tetrathionate salts in the inks disclosed therein. Vieira et al. teaches simple addition of lightfastness agents of the given formula into inks, and neither teaches nor suggests that such agents could or should form complexes with other ink ingredients. Vieira et al. further fails to teach or suggests inks containing polyquaternary amines. One of ordinary skill in the art would not be motivated to view these particular references in combination and would not be led to make an ink wherein <u>both</u> an anionic dye and an anionic lightfastness-imparting agent are complexed to a polyquaternary amine. . . . [Brief then quotes from application and cites case law on obvious to try standard and that "references" do not teach or suggest claims 12 and 13 with discussion identical to that on pages 24 to 28]. (Appeal Brief, pages 11 to 15).</p>	<p>Appellants disagree with this position. Gundlach et al. neither teaches nor suggests the use of lightfastness agents such as ultraviolet absorbers, thiosulfate salts, trithionate salts, or tetrathionate salts in the inks disclosed therein. Bergthaller et al. and Ma et al. both teach simple addition of lightfastness agents into inks, and neither teach nor suggest that such agents could or should form complexes with other ink ingredients. Bergthaller et al. and Ma et al. further fail to teach or suggest inks containing polyquaternary amines. One of ordinary skill in the art would not be motivated to view these particular references in combination and would not be led to make an ink wherein <u>both</u> an anionic dye and an anionic lightfastness-imparting agent are complexed to a polyquaternary amine. . . . [Brief then quotes from application and cites case law on obvious to try standard and that "references" do not teach or suggest claims 12 and 13 with discussion identical to that on Appeal Brief pages 11 to 15 and pages 24 to 28]. (Appeal Brief, pages 37 to 41).</p>

Smith's arguments regarding the rejection over Gundlach '505 in view of Bergthaller '657 or Ma '523 have been fully considered. For essentially the same reasons provided above with

respect to two other obviousness rejections involving Gundlach '505, we conclude that Smith claims 1-4 and 11-25 are obvious over Gundlach '505 in view of either Bergthaller '657 and obvious over Gundlach '505 in view of Ma '523. As stated above, ordinary skill in the art was well aware that there was a need in the art for ink compositions with improved lightfastness.

Further, a stated objective of Gundlach '505 is "to provide ink compositions with improved lightfastness." (Gundlach '505, col. 6, lines 3-4 and 40-41). A person of ordinary skill in the art desiring the benefits of Gundlach '505's improved anionic dye ink jet composition, bright colors, low cost, etc. would have been motivated to include the anionic lightfastness agent of Bergthaller '657 or Ma '523 as both Bergthaller and Ma teach that the inclusion of such agents improves the lightfastness of an ink composition. Further, as discussed above, a natural consequence of combining the anionic dye, anionic light-fastness agent and the cationic polyquaternary amine is the formation of a complex.

With respect to Smith claims 12 and 13, Smith argues that there is nothing in the combination of the cited references that teaches or suggests Smith claim 12's ratio of cationic sites to anionic sites or Smith claim 13's molar ratio of dye molecules to lightfastness-imparting agent. (Appeal Brief, p. 41). A prima facie case of obviousness arises when the ranges of a claimed composition overlap the ranges disclosed in the prior art. *In re Woodruff*, 919 F.2d 1578, 65 USPQ2d 1934, 1936 (Fed. Cir. 1990). Further, where the general conditions of the claims are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Gundlach '505 teaches that it is preferred that the number of quaternary amine groups on the polyquaternary amine compound exceeds the number of anionic groups on the dye to avoid

precipitation. Smith does not argue or allege that the ratio of cationic sites to anionic sites in Smith claim 12 provides an unexpected result. Accordingly, we conclude that one of ordinary skill in the art aware of the teachings of Gundlach '505 and Bergthaller '657 and/or Ma '523 and would have been motivated to form the claimed ink jet composition and guided by Gundlach's warning of precipitation would have been led to the claimed ratios.

With respect to Smith claim 13, Gundlach '505 discloses using 1-5% anionic dye and Bergthaller '657 teaches using 0.2-8% lightfastness agent and Ma '523 teaches using 1-8% lightfastness agent. Using these values, the ratios taught by Gundlach '505 and Bergthaller '657 are 0.125:1 to 5:1 and by Gundlach '505 and Ma '523 are 0.125:1 to 50:1. (Examiner Answer, p. 19). We remind Smith that:

Selecting a narrow range from within a somewhat broader range disclosed in a prior art reference is no less obvious than identifying a range that simply overlaps a disclosed range. In fact, when, as here, the claimed ranges are completely encompassed by the prior art, the conclusion is even more compelling than in cases of mere overlap. The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.

We therefore conclude that a prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness. That is not to say that the claimed composition having a narrower range is unpatentable. Rather, the existence of overlapping or encompassing ranges shifts the burden to the applicant to show that his invention would not have been obvious, as we discuss below.

*In re Peterson*, 315 F.3d 1325, 1331, 65 USPQ2d 1379, 1383-84 (Fed. Cir. 2003). Smith does not argue, let alone allege, that its narrower range provides unexpected results. We conclude that the generally known broader ranges taught by Gundlach '505 in combination with either

Bergthaller '657 or Ma '523 provided one of ordinary skill in the art the motivation to optimize the ratio of dye to lightfastness agent and arrive at Smith's claimed ratio.

4) Smith's Reply Brief

Smith's Reply Brief addresses two issues. First, Smith argues that the examiner's position regarding the formation of a polyquaternary amine/anionic dye complex with anionic lightfastness agent is "a classic example of the use of hindsight." (Reply Brief, p. 1). Smith also argues that one of ordinary skill in the art "would not have known what would happen when the elements of the instant invention were combined." (Reply Brief, p. 2, emphasis in original).

Smith's hindsight argument has been addressed above. Again, the motivation in the prior art to combine the Gundlach and the Vieira, Bergthaller and Ma references and establish the obviousness of Smith's claimed subject matter does not have to be identical to the motivation identified by Smith. *In re Dillon*, 919 F.2d at 693, 16 USPQ2d at 1901.

We are puzzled by Smith's arguments that one of ordinary skill in the art would not have known what would happen when the claimed elements are combined. The prior art references teach that the inclusion of lightfastness agents in ink jet compositions will improve the lightfastness of the ink. That Smith's specification describes and exemplifies specific compositions and provides a theory of how lightfastness is improved does not lead to a conclusion that one of ordinary skill in the art would not expect an ink jet lightfastness agent to provide lightfastness properties when used in an ink jet composition such as that described by Gundlach '505.

To the extent Smith's argument might be that one of ordinary skill in the art would not

have known that a complex would form between the claimed dye, lightfastness agent and polyquaternary amine, it is unavailing. The prior art provides a reasonable basis for concluding that a complex would form when the lightfastness and dye anions and their counter cations in the polyquaternary amine are combined and Smith does not argue or show otherwise.

Based upon the record presented we affirm the examiner's rejections.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

*AFFIRMED*

/ss/ Richard Torczon )  
RICHARD TORCZON )  
Administrative Patent Judge )

/ss/ Carol A. Spiegel )  
CAROL A. SPIEGEL )  
Administrative Patent Judge )

/ss/ Michael P. Tierney )  
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